CLAIMS

1. A method of detecting the presence of slag in a shroud (4) for guiding molten metal from a ladle (2) to a tundish (6), the method comprising:

generating, by means of at least one transmitting coil (20), an electromagnetic field that enters the shroud and its contents;

generating an induced voltage by means of at least one receiving coil (24) which is subjected to the electromagnetic field having entered the shroud and its contents, wherein any induced voltage having a value outside a defined voltage range is indicative of the presence of slag in said contents;

determining the flow of the molten metal passing through the shroud; and

defining said voltage range depending on the magnitude of the determined flow of molten metal.

2. The method as claimed in claim 1, further comprising:

keeping the coils substantially unmovable relative to the shroud.

3. The method as claimed in claim 1 or 2, further comprising:

providing a forked coil holder (10) having at least two branches;

mounting the transmitting coil to a first branch (14) and the receiving coil to a second branch (16) of the forked coil holder; and

placing the forked coil holder in such manner that an imagined straight line drawn between the transmitting coil and the receiving coil crosses the shroud.

4. The method as claimed in claim 3, wherein the act of placing the forked coil holder comprises mounting said forked coil holder to a shroud manipulator (30).

5. The method as claimed in claim 3, wherein the act of placing the forked coil holder comprises mounting said forked coil holder to a separate mounting device that is arranged to follow the position of the shroud.

6. The method as claimed in claim 3, wherein the act of placing the forked coil holder comprises mounting said forked coil holder to a sliding gate at the ladle.

7. The method as claimed in claim 1 or 2, further comprising:

providing said at least one transmitting coil in toroid form and arranging it so as to surround the shroud, and

providing said at least one receiving coil in toroid form and arranging it so as to surround the shroud.

8. The method as claimed in any one of claims 1 - 7, further comprising:

detecting turbulent flow, if any, inside the shroud; and

changing the frequency of the electromagnetic field generated by the transmitting coil in case of turbulent flow having been detected.

9. The method as claimed in any one of claims 1-8, further comprising generating, by means of said at least one transmitting coil:

an electromagnetic field of alternating frequencies, or

several electromagnetic fields with different frequencies.

10. The method as claimed in any one of claims 1 -9, further comprising:

defining a larger voltage range if it is determined that the magnitude of the flow of molten metal has decreased.

11. The method as claimed in any one of claims 1 - 10, wherein the act of determining the flow of molten metal passing through the shroud comprises:

providing feedback from an opening position signal of a sliding gate at the ladle and calculating the flow of molten metal from the sliding gate opening information.

12. The method as claimed in any one of claims 1 - 10, wherein the act of determining the flow of molten metal passing through the shroud comprises:

measuring the rate of decrease in weight of the ladle content and calculating the flow of molten metal from said measured rate of decrease in weight.

13. The method as claimed in any one of claims 1 - 10, wherein the act of determining the flow of molten metal passing through the shroud comprises:

measuring the teeming rate in the tundish and calculating the flow of molten metal from said measured teeming rate.

14. The method as claimed in any one of claims 1 - 13, further comprising:

cooling said transmitting and receiving coils.

15. A device for detecting the presence of slag in a shroud (4) for guiding molten metal from a ladle (2) to a tundish (6), comprising:

at least one transmitting coil (20) for generating an electromagnetic field to be entered into the shroud and its contents;

at least one receiving coil (24) for receiving the electromagnetic field that has entered the shroud and its contents, and for generating an induced voltage, wherein any induced voltage having a value outside a defined voltage range is indicative of the presence of slag in said contents;

means for determining the flow of the molten metal passing through the shroud; and

means (52) for defining said voltage range depending on the magnitude of the measured flow.

16. The device as claimed in claim 15, further comprising a coil holder arrangement which is mountable in such manner that the coils are enabled to substantially follow positional variations of the shroud.

17. A device as claimed in claim 16, wherein said coil holder arrangement comprises a forked coil holder (10) having at least two branches, a first branch (14) carrying the transmitting coil(s) and a second branch (16) carrying the receiving coil(s), the two branches being placeable in such manner that the shroud is located between them.

18. The device as claimed in claim 17, wherein the forked coil holder is adapted to be mounted to a shroud manipulator (30).

19. The device as claimed in claim 17, wherein the forked coil holder is adapted to be mounted to a separate mounting device which is arranged to follow the position of the shroud.

20. The device as claimed in claim 17, wherein the forked coil holder is adapted to be mounted to a sliding gate at the ladle.

21. The device as claimed in any one of claims 17 - 20, wherein said two branches are electrically isolated from each other.

22. The device as claimed in claim 15 or 16, wherein said coils are in the form of toroids, wherein said coil holder arrangement is adapted to hold each toroid in such manner that it surrounds the shroud.

23. The device as claimed in any one of claims 15 - 22, wherein said means for determining the flow of the molten metal passing through the shroud comprises:

a sensor for sensing an opening position signal of a sliding gate at the ladle, and

a processor for calculating the flow of molten metal from the sliding gate opening information.

24. The device as claimed in any one of claims 15 - 22, wherein said means for determining the flow of the molten metal passing through the shroud comprises:

a measuring device for measuring the rate of decrease in weight of the ladle content, and

a processor for calculating the flow of molten metal from said measured rate of decrease in weight.

25. The device as claimed in any one of claims 15 - 22, wherein said means for determining the flow of the molten metal passing through the shroud comprises:

a measuring device for measuring the teeming rate in the tundish, and

a processor for calculating the flow of molten metal from said measured teeming rate.

26. The device as claimed in any one of claims 15 - 25, wherein the transmitting and receiving coils are provided with directional elements, such as a core, for directing the electromagnetic field towards and from the shroud.

27. A casting plant, comprising

a ladle (2) adapted to contain molten metal;

a tundish (6) adapted to receive molten metal from the ladle;

a shroud (4) arranged between the ladle and the tundish, wherein molten metal is enabled to pass from the ladle, through the shroud, and to the tundish; and

a device as claimed in any one of claims 15 - 26.